

# Multi-User Droplet Combustion Apparatus (MDCA)/ Flame Extinguishment Experiment-2 (FLEX-2)



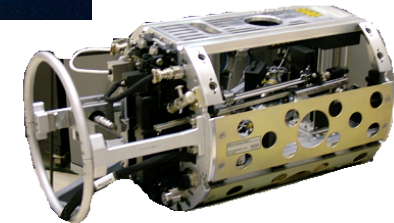
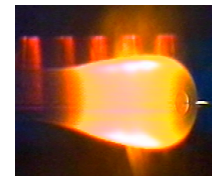
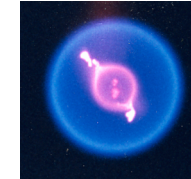
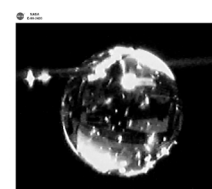
**PI Team:** Prof. Forman Williams, UCSD (lead)  
Prof. Frederick Dryer, Princeton  
Prof. Mun Choi, Drexel University  
Prof. Benjamin Shaw, USC-Davis  
Dr. Vedha Nayagam, NCSSER

**PS:** Dr. Daniel Dietrich, NASA GRC

**PM:** Terence O'Malley, NASA GRC

**Engineering Team:** ZIN Technologies, Inc.

Glenn Research Center



*Clockwise: Image of Bi-component fuel droplet; color image of burning single fuel droplet; FLEX Chamber Insert Assembly Apparatus; image of burning droplet subjected to convective flows.*

## Objective:

- ♦ Modular apparatus designed for fundamental droplet combustion investigations
  - Investigate bi-component fuels
  - Examine the influence of sub-buoyant convective flows
  - Study practical fuels
  - Extend single droplet studies to binary arrays of droplets

## Relevance/Impact:

- ♦ Extend single droplet combustion studies of pure fuels to consider idealized fuel mixtures and practical fuels
- ♦ Extend single droplet combustion studies to environments more relevant to engines (droplets in a flow-field and droplet-droplet interactions).
- ♦ Use experimental data to develop verified detailed and reduced-order models of droplet combustion.

## Development Approach:

- ♦ PI unique fuel/gas containers built and launched to existing on-orbit Chamber Insert Assembly minimizing up-mass/volume, costs, and crew involvement

## ISS Resource Requirements

<b>Accommodation (carrier)</b>	Combustion Integrated Rack
<b>Upmass (kg)</b> (w/o packing factor)	50 kg
<b>Volume (m<sup>3</sup>)</b> (w/o packing factor)	0.08 m <sup>3</sup>
<b>Power (kw)</b> (peak)	0.73 Kw
<b>Crew Time (hrs)</b> - Initial configuration of CIR Rack - Change-outs during experiment	8.5 hrs 8.3 hrs
<b>Autonomous Ops (hrs)</b>	TBD
<b>Launch/Increment</b>	19A/TBD

## Project Life Cycle Schedule

Milestones	SCR	RDR/PDR	CDR	VRR	Safety (PH-3)	PSR	Ship	Launch	Ops	Return	Final Report
Actual/ Baseline	Nov 2007	May 2008	Dec 2008	Mar 2009	Apr 20089	Aug 2009	L-4	Dec 2009	Apr 2009	Jul 2010	Jul 2011